Research Connects

Communicating and understanding postgraduate research

Postgraduate Research Conference

Faculty of Engineering and Environment
Northumbria University
15th June 2017

Foreword

Research Connects

Communicating and understanding postgraduate research

Postgraduate research students in the Faculty of Engineering and Environment work across an extraordinary range of interests and disciplines. Common to all is the need to communicate with and engage non-expert audiences. Whether working in cross-disciplinary teams, exchanging knowledge with external collaborators, or disseminating findings and applying these in the public realm, it is essential that the particular language and concepts of our disciplinary area are communicable and understandable by those beyond our own area of expertise.

The Engineering and Environment PGR conference aims to encourage participation and cross-disciplinary communication by providing a safe and friendly environment for feedback, exchange and reflection. With students from all five departments represented in both the presentations and the posters, the challenge has been to retain the richness and complexity of the work, while clearly communicating the intended meaning to a non-expert audience.

Take note of you the contributions you find most successful and engaging - you will be asked to vote for the best poster and best presentation using stickers at the end of the day. There will be a prizes for each, presented during the final reception.

I hope that this conference will provide the conditions for the emergence of new ways of seeing, new ways of thinking and for surprising academic connections to be made.

Rosie Parnell
E&E PGR Director
Northumbria University

Keynote Speaker

Dr Alex Hope

Senior Lecturer in Business Ethics, Newcastle Business School
Northumbria University

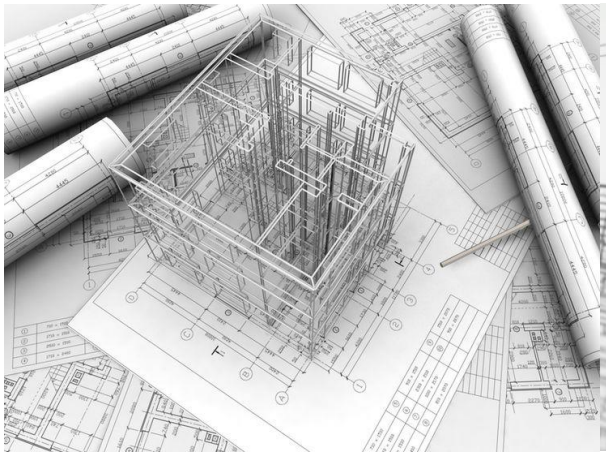
A PhD alumnus of the Engineering and Environment Faculty, Alex now works in Newcastle Business School (NBS) in the faculty of Business and Law. Prior to joining NBS, Alex was Lecturer in Sustainable Development and Project Management in the Faculty of Engineering and Environment, where he specialised in sustainable project management, sustainable construction and energy policy. He has over 15 years of experience working in management and leadership roles in private and public sector management positions across a diverse range of sectors including retail and local government and as director of a sustainability and leadership consultancy.

Alex's teaching specialisms include Sustainable Development, Sustainable Business, Corporate Social Responsibility and Business Ethics, which he delivers across a wide range of undergraduate and postgraduate programmes in addition to supervising doctoral students. He holds a BSc in Environmental Management,
PhD in Sustainable Development and is currently completing an MA in Academic Practice.

Bridging the barrier between academia and the 'real world'

In his opening address, Alex will draw upon the story of his own career development and reflect on the importance of communicating outside of the academy, to offer some tips on career development from PGR to Academia to Industry and beyond.

Abstracts



Architecture & Built Environment

Adejimi, Adebayo

Exploring Datasets Needed in Reconfiguring Retail Spatial Network | ABE | Presentation

Big data have emerged due to high increase in volume, velocity and variety of datasets available to users (Mysore et al, 2013; CBR, 2017). As such, data users (including; researchers, planners, developers, investors and other city actors) are much interested in exploring existing datasets in order to economize resources among other motives (CBR, 2017). This paper is an extract of an ongoing research that aims at *enhancing performance of retail space through reconfiguration of spatial network*. It aims to explore potential of datasets required in executing the ongoing research aim. It attempts to answer the following questions:

1. What are the characteristics/attributes of datasets available from resource providers?
2. What are the pros and cons of these datasets in relation to the available computerised tools?
3. What is/are the most appropriate datasets for the ongoing research and, Why?

City actors are no longer troubled with gathering timely data about cities, but concerned with how to integrate the vast available datasets to obtain useful information (Thompson, et. al, 2016). Resource providers often have different data characteristics in terms of types, frequency, volume, veracity and so on, hence, knowledge (about the datasets) and intelligence are required in integrating datasets to have useful outputs (Mysore et al, 2013; Thompson et al, 2016). This paper will explore available datasets that have potential usability in the ongoing research. Characteristics of such datasets including strengths and weaknesses will be evaluated, and justifications on the choice(s) of datasets will be drawn.

Babelon, Ian

Virtual cities for public engagement | ABE | Presentation

Online mapping surveys are increasingly used to engage residents in urban planning. They can now be deployed in the form of 2D maps (e.g. based on Google maps), as well as 3D map environments (e.g. based on Google Earth or Open Street Map 3D). At their best, they can function as highly interactive types of virtual cities for public engagement. Thanks to them, residents can comment on planning proposals and suggest alternative land uses. Despite their increasing popularity, many online mapping survey software are not covered in the scientific literature. Particularly, few if any studies have compared the use of 2D and 3D online mapping surveys from the perspective of end-users.

The aim of the research is to explore the role of online mapping surveys in urban planning. The state of the art will address issues of urban governance, particularly how online mapping surveys can support decision-making. The literature review will be complemented with surveys of urban planners who have used such Public Participation GIS software for engaging urban residents.

Based on comparative usability workshops and light ethnography, the core of the research will compare the user experience of 2D and 3D online mapping surveys. The main hypothesis is that different users will have different contextually-specific needs, which will be met by different tool functionalities. In other words, it is expected that “one tool does not fit all”.

Brown, Laura

Building Adaptability in Olympic Construction | ABE | Presentation

The Olympic Games is the largest sporting mega event of its type, with deep cultural and historical roots. Hosting the Games holds honour and prestige for host cities, with the potential to facilitate urban regeneration. But the construct of the Games is problematic, as the buildings required to host the Games have very specific infrastructural requirements and a lifespan of less than three weeks for their immediate function. As legacy and sustainability have risen on public and political agendas, the adaptability of Olympic buildings has become increasingly more important to promote positive legacies in the post-Games use of Olympic infrastructure. This research examines models of adaptability in Olympic design using case studies from previous Olympic host cities of the Summer Olympic Games in Europe, (1948-2012). As part of a broader PhD thesis scrutinising the post-Games legacy of four building typologies (Stadium, Aquatics Centre, Velodrome, Athletes Village) across each of the post-War Olympic sites in Europe, (London 1948, Helsinki 1952, Rome 1960, Munich 1972, Barcelona 1992, Athens 2004, London 2012), a mixed methods approach, (archival research and direct observation), has been used to develop a framework to assess how aspects of urban and architectural design contribute to legacy outcome. The originality of this research is its analysis of Olympic infrastructures and sustainability, of which there is a current lack of comparative studies in academic research. Its significance to architectural practice, academia, and society, is its potential to benefit future Olympic Games, IOC policy, and be extended to other Mega Sporting Events.

Henriques, Diogo

Experimenting: an interdisciplinary view | ABE | Presentation

During the 20th century, several top-down urban visions were proposed by distinct stakeholders interested in urban processes, and some of those visions were actually planned, built, and can be experienced today as best practice examples of urban planning around the world. While some of those top-down visions for cities allowed global innovations in such fields as politics, economy, and urban planning, they also triggered a reaction of bottom-up approaches that promoted local and neighbourhood engagement, which can be traced until today. Furthermore, new generations of researchers and practitioners continue to advance the field of urban planning, in order to determine its present and future impact. How can we measure the impact of future urban visions? Which evaluation methods, from such fields as cognitive sciences and human computer interaction, could advance participatory planning processes for public spaces in local contexts? In this paper, we describe a pilot study that aims to experiment evaluation methods of public participation for future urban visions. We present methods and results of this study with postgraduate students from distinct disciplinary backgrounds at Northumbria University (UK), and we discuss further methods to measure the impact of future visions. Finally, we sketch further work supporting creativity within participation processes for tomorrow's cities.

OBS: This paper was originally presented under the title 'Measuring the Impact of Future Visions through Card Sorting - From User Experience to Participatory Planning (a Pilot Study)' at the INCUBATORS Conference - Urban Living Labs for public space. A new generation of planning?, at KU Leuven, Faculty of Architecture, Campus Sint Lucas, Brussels, Belgium, 10-11 April 2017

Nguyen, Vinh Nhat

Integrating disaster risk reduction into the built environment in Vietnam | ABE |Poster

For decades, Vietnam has been recognized as one of the most exposed and vulnerable countries to the impact of climate change and its phenomenon including natural disasters and extreme weather events. Nonetheless, the achievements of the Vietnamese built environment in integrating disaster risk reduction (DRR), which is strongly emphasized in the United Nation's Sendai Framework, has remained considerably limited due to various problems. Meanwhile, research on areas of disasters and the built environment in respect to the country's specific context is currently nebulous and sporadic. This study presents an investigation into existing issues and seeks for improvement in integrating DRR into the built environment in Vietnam. Correspondingly, a country case study is adopted as the research strategy implemented by the use of questionnaire survey and in-depth interview as primary techniques. Following data collection, a precise list of critical causal factors that lead to limitations in adopting DRR in construction industry and the built environment in Vietnam will be established. Based on this ground, a framework that employs a range of instruments and strategies to overcome existing obstacles in the purpose of directing towards successful integration of DRR in the Vietnamese built environment will be developed, which is of special importance to all Vietnamese public and private sector stakeholders in recognizing and implementing DRR in their practices that contribute to the construction and development of residential properties, public buildings, national facilities and infrastructure.

Ponton, Hazel

An investigation into socially orientated competencies in the practice of Design Management in Construction | ABE | Poster

The innovative practice of Design Management (DM), within the context of medium to large UK construction contractors, has been rapidly adopted since the turn of the twenty-first century. The practice involves both task and socially orientated competencies. Both of which have a direct impact on the success of the design process and therefore the overall success and outcome of a construction project. Despite this, research relating specifically to the contractor's DM performance is sparse. The aim of the ongoing project is to examine socially orientated competencies, applying Organisational Psychology (OP) theory, to model best practice of contractor's DM role within construction projects. The overarching hypothesis is that within the contractor's Design Management role, there are socially-orientated competencies that affect the performance of that role. A mixed-method approach will be adopted to investigate construction projects. The projects will contain similar attributes in terms of procurement route (contractor-led) and overall project value. A established OP data collection method will be used to measure the DM practitioner's socially orientated competency. Three key stakeholder groups, namely Design Team, Client Team and Construction Team, will complete an additional survey to measure their perception of the DM practitioner's competency performance. Following analysis of the data, associations between the independent and dependent variables will be identified and explored. Finally, a focus group formed from pre-selected industry experts will provide a video-recorded discourse and narrative regarding the research project's correct theoretical specification.

Sarham, Heba

Home Outside the Boundaries | ABE |Presentation

The proposed presentation discusses manifestations of self-identity within the thresholds of the places of dwelling in situations of relocation. In such situations, inhabitants experience a tentative relationship with the surrounding community accompanying the process of establishment of emotional bonding with the new context of dwelling.

The discussion draws on a review of literature led by the following enquiry:

How to understand the impact of the outer context on the inhabitants' manifestations of self-identity within the realm of the threshold?

The objective underlying this quest is to spot the light on the following issues: First, understanding identity as a dynamic attribute of the inhabitants' conception of home. Second, different approaches sought for exploring manifestations of identity. Third, the impact of the inhabitants' relationship with the outer community on manifestations of self-identity inside the place of dwelling. And finally, understanding the realm of the threshold as a social space.

The outcome of the review highlights the following dimensions upon the manifestations of self-identity in the threshold. First, inhabitants' intended statements regarding their self-identity. Second, the reflection of changes in self-identity as a result of the inhabitants' interaction with the new context of dwelling.

Wir-Konas, Agnieszka

Dwelling-street interface and the spatial in-between – a case study in Newcastle upon Tyne | ABE | Presentation

When we view urban tissue as a patchwork of various elements (buildings, streets, public spaces, interiors), each element is a subset and interacts with adjacent elements. The space, which is an outcome of two urban domains meeting in one point, can be called an interface and the specific case of the interface, the dwelling-street interface, is the main focus of this work. The dwelling-street interface is influenced not only by the private house, but also the adjacent street segment which is a part of a larger scale street network. The pilot study conducted as a part of this work showed that the structure of the dwelling-street interface changes depending both on the type of the street segments and the building typology. Considering a house in isolation without studying its interfaces, potentially overlooks additional and important information intrinsic to the house itself. The aim of this study is to add another layer of detail to urban research in order to come a step closer to explaining the complexity of the built environment. The main contribution to the body of knowledge is the provision of empirical data on the relationship between British dwellings and streets, and a method of representing this relationship.

Young, Shaun

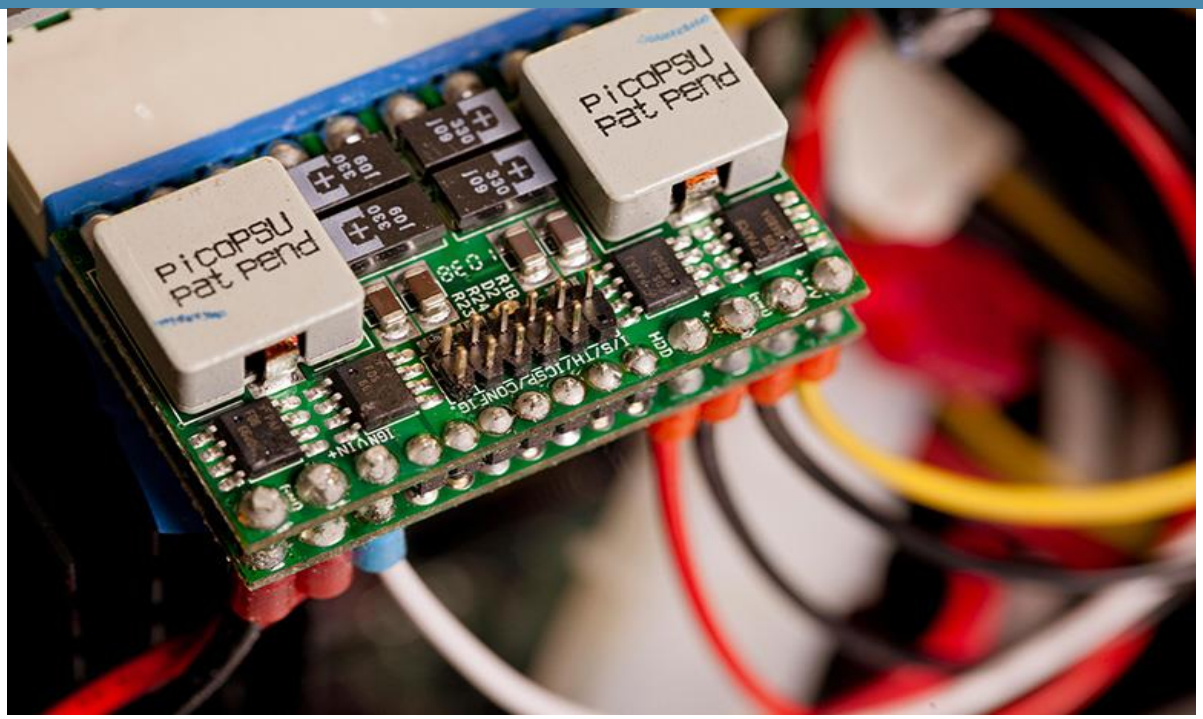
The Picturesque as an Emerging Sensibility. Architectural Interventions in the Contemporary Landscape | ABE | Presentation

This practice-based PhD explores notions of the picturesque through the making of design projects in response to a series of distinct and contemporary landscape conditions.
In the late eighteenth century, Uvedale Price added the picturesque to Edmund Burke's antithetical aesthetic categories of the sublime and the beautiful. Price's picturesque allowed for the aestheticisation of landscapes and objects previously deemed unworthy of artistic attention. The picturesque moves away from the idealised landscapes of the mind and into a more physical understanding of place based upon direct experience. This presentation will describe design research to date. Design projects for an architectural intervention at Croome Court in Worcester, and for the reconfiguration of a house and garden overlooking the Teign Estuary in Devon explore the genesis of the picturesque interregnum between the classical and the romantic. The connection between the picturesque and the aestheticisation of the industrial landscape is considered in a project for an art institution on the edge of a ship yard in the Podil district of Kiev, and through a series of building propositions for the post-industrial landscapes of the North east of England.
Individually, design projects begin to populate and critique the framework for design.

Zied, Eman

Understanding the Emergence, Growth and Resilience of Informal Settlements in Cairo, Egypt | ABE | Poster

Cairo suffers from unchecked urban growth that manifests as the formation of informal settlements on the edges of the main urban core. This research aims to create a new definition of informality that is rooted in the physical geography, emergence, growth and urban morphology of the settlements, which may be legally informal but in fact follow strict formal rules and are connected to the city and may fulfil users' needs better than the planned housing developments. Different social and physical factors are studied and used to identify and classify different types of informal growth to create a normative decision making framework for the necessity and practicality of intervention, in order to prioritise intervention on the basis of need using social indicators of poverty and develop intervention strategies on the basis of the informal settlement typology. This study uses space syntax, urban morphology and cognitive mapping as main analysis tools. Using all three together covers the physical form, connectivity to the rest of the city and social aspects of the case studies. The poster provides a critical review of government policy and the historical narrative that led to the emergence of informal settlements, current trends in research in informality in Egypt and the social indices and projects that have been developed. It also presents the research design and an overview of the methodology used; their development and suitability for use in this type of study, as well as a pilot case study to develop the methodology further.



Computing & Information Sciences

Agin, Halil

Towards a Taxonomy and Analysis of Characteristics of Data Uncertainty in Visualization | CIS | Poster

While scientific data rarely can be collected or generated without uncertainty association, the visualization of uncertainty still remains an unresolved problem and preserves its position as one of the most important challenges in information visualization. Some initial attempts have been made to establish a taxonomy and guidance for the visualization of uncertainty in data. Potter et al. provides an initial research direction for uncertainty visualization by identifying uncertainty types and categorizing their visualization based on data dimensionality.

This research builds upon previous uncertainty categorization to improve and define a taxonomy for uncertainty visualization, and through this identify relationships between the characteristics associated with uncertainty (CAU) e.g. data type, visualization approach, application area and analysis models. This taxonomy will then provide support in developing guidance to scholars as to how uncertainty in data may be most efficiently visualized within a given context.

Initial results indicate a relationship between visualization that use static comparison for uncertainty analysis (UA) and intrinsic visualization approaches (IV), as well as between dynamic UA and IV, whereas a relationship between dynamic UA and extrinsic visualization (EV) cannot be observed,

There are two main contributions of this study: 1) a robust categorization for the characteristic associated with uncertainty phenomenon in visualization; 2) a thorough analysis of relationships among CAU by visualization and correlation analysis using methods such as PLS and LR.

Aljabali, Sanaa

Investigation into undergraduate international students' use of digital technology and their application in formal and informal settings | CIS | Poster

Digital technologies are widely used in education but do not always consider the student perspective. This study investigates how international STEM undergraduate students are using technology to support their learning inside and outside the classroom. The results from data analysis of a large survey and a set of individual student interviews demonstrate that students use technology in many ways to support their learning often showing a preference for technology that is outside the formal university systems. This suggests universities need to re-evaluate their approach to technology enhanced learning to ensure it is meeting student needs and addresses cultural differences. Students are using mobiles and laptops as their main digital devices rather than desktop computers. They use a variety of software and digital systems ranging from the university provided virtual learning environment and email systems through to online videos, websites and wikis. They typically spend more time using technology off site than on campus. They usually work face to face with other students to share practice, resources and seek help to queries but email, messaging (e.g. SMS) and social media (e.g. Facebook) are all popular too. They rarely use the formal university systems for collaborative learning. They sometimes find it difficult to source relevant information from the web and occasionally have technical issues with the technology. There appear to be cultural difference in the preference of students for using different sorts of technology, for example, with those from the USA and Europe more comfortable in using text and social media compared to those from the Middle East. These results suggest that students are relying on technology to support their learning in a variety of ways and are becoming increasingly mobile in their approaches to this. It also suggests that they are using technology outside the formally provided university systems. This suggests that there needs to be a re-evaluation of the approaches to technology enhanced learning across the higher education sector to ensure they are meeting the needs of these students and that they account for the different cultural backgrounds of our international student population.

Brazier, David

e-Government interaction and the on-line information behaviours of English as a second language users | CIS | Presentation

Interacting with information in an on-line capacity is common place for many people nowadays. However, there remains a considerable section of society whose skills, knowledge and experience in such activities are creating significant barriers to essential services.

This research aims to investigate the information interaction behaviours of English as a second language users of on-line governmental services in the UK.

Work has already begun on identifying what this user group understands by the term governmental service and the skills and information needs necessary to interact with such services on-line. Further to this, lab experiments were conducted to observe the information interaction of 29 PhD students with findings from the study revealing significant differences in the behaviours of participants given their perceived confidence (and self-assessed proficiency) in using English in contextually relevant search situations.

Initial findings have shown that those participants identified as Non-native English language users who were most confident took riskier strategies and were less thorough in their search.

Although they performed to the best of their abilities, deemed that they were bookmarking documents of relevance to the task (when the opposite was true) and that the tasks were easy, these users were not able to correctly determine their actual performance despite their confidence in their overall performance. Following on from this, work has begun comparing these groups behaviour and performance against those of native English speakers.

Bugaje, Maryam

Towards A Specialized Data Retrieval Method | CIS | Poster

The past few years have seen a huge wave of advocacy, institutional mandates, and support for sharing data generated through publicly funded research. For the full benefits of data sharing to be realized, however, interested parties and researchers must be able to find data when they need it. The fundamental characteristics, as well as form of user interaction with data, differ considerably from those of research publications, and this calls for different and specialized retrieval methods to those employed for the latter. As this problem is still relatively new and as yet not very well understood, most research data repositories currently use the same retrieval engines for research data as are used for publications, albeit, in some instances, slightly tweaked. This paper, through a systematic experiment, establishes the fundamental and deep-rooted differences between research publications and data, and argues for a specialized data retrieval method for the latter.

Emembolu,Itoro

The impact of academic research on young people's uptake of STEM disciplines | CIS | Poster

The study is aimed at appraising the impact of academic research on young people's interest in the STEM (Science Technology Engineering and Mathematics) disciplines by establishing a multidisciplinary impact evaluation framework. This would be achieved using a collection of instrumental case studies from interventions across the STEM disciplines including engineering, mathematics, computing, geography and built environment. The study adopts an iterative plan-act-evaluate design that would combine process evaluation and impact evaluation for an effective evaluation framework to determine if change(s) has occurred due to the interventions and also explain why the observed changes The interventions are targeted at young people aged 7 – 11 years and are drawn from Northumbria University's NUSTEM partner and non-partner primary schools in the North East. The focus is on the interface between outreach activities based on research work done by academic researchers and practical applications that bring to life STEM subjects for young people. This study is important because even though there are many STEM interventions (past and ongoing) with substantial funds invested in them, there is still little evidence on the effectiveness of those interventions. Also, Interventions based specifically on academic research outputs are usually aimed at secondary or tertiary level students.

Hastings, David

The Collaborative Behaviors of Home-Based Businesses: Why, What and How? | CIS | Poster

One of the greatest obstacles facing Home-Based Businesses (HBBs) is a lack of understanding regarding their importance and overall contributions, and the resulting lack of policy-level support for the sector. Whilst at present the commercial aspects of HBBs are not studied with any regularity, it has been noted within the literature that research into the economic contributions of HBBs would be of interest to stakeholders including policy makers, academics and HBB entrepreneurs.

Current research on HBBs is focused primarily on the lifestyle aspects of home-based working, such as work-life balance and social exclusion, and predominantly draws from small-scale qualitative studies. In contrast, this research utilises the Global Entrepreneurship Monitor (GEM) dataset, containing records on tens of thousands of HBBs, and will employ data mining and data analysis techniques to identify trends and patterns within the data. As opposed to the anecdotal approach commonly used in HBB centred research, this study will use a data-driven approach to provide empirical evidence on the collaborative practices of HBBs and framework of interactions most beneficial for business development in addition to the identification of factors – both internal and external – which are most conducive to the formation of collaborative behaviours.

Findings from the literature indicate that for the real-world impact of HBBs to be understood an appreciated, they must be perceived as important agents engaged in collaborative enterprise and as actors in larger networks. This research positions itself to contribute evidence towards this goal.

Le Louvier, Kahina

Cultural Information Needs on the Move: How Can Local Cultural Institutions and Civil Society Organizations Foster Social Inclusion of Migrants, Refugees and Asylum Seekers? | CIS | Presentation

The aim of this PhD project is to investigate how information practices of migrants, refugees and asylum seekers are negotiated within their new local cultural environment and what may facilitate their fuller participation in society. Social inclusion builds on both the capacity to fully engage with the cultural, social, political, and economic dimensions of society, and the development of a sense of belonging and recognition. Using a Participatory Action Research approach and combining Information Science with a Cultural Heritage perspective, this research explores how local cultural institutions and civil society organisations can join forces to foster the social inclusion of vulnerable migrants in Newcastle.

Li, Jie

Intrusion detection system by fuzzy interpolation | CIS | Presentation

Network intrusion detection systems identify malicious connections and thus help protect networks from attacks. Various data-driven approaches have been used in the development of network intrusion detection systems, which usually lead to either very complex systems or poor generalization ability due to the complexity of this challenge. This paper proposes a data-driven network intrusion detection system using fuzzy interpolation in an effort to address the aforementioned limitations. In particular, the developed system equipped with a sparse rule base not only guarantees the online performance of intrusion detection, but also allows the generation of security alerts from situations which are not directly covered by the existing knowledge base. The proposed system has been applied to a well-known data set for system validation and evaluation with competitive results generated.

Li, Zequn

Improve Online Shopping Experience with Self Identity Theory | CIS | Presentation

The Self Identity theory describes a result of different unconscious generalizations about self-becoming dominant at different times, in different social or cultural settings. Previously, it is a topic of concern throughout the humanities, cognitive science, psychology, and psychoanalysis. In this project, we firstly tried to use the Self Identity theory to describe the Online Shopping Behaviour, then with using information extracted by Computer Vision, we enhanced the current recommendation system based on Self Identity theory. The new recommendation strategy different customer behaviour from harmonious to vulnerable and behaves different according to different products and customer groups.

Ogutcen, Omer Faruk

An ensemble of Sequential Forward Search and Pareto Optimal for the discovery of biomarkers in cancer microarray data | CIS | Presentation

Computational methods have been performed to determine essential features of microarray datasets that aim to enhance the efficiency of biomedical domain applications. Feature selection is an essential process. To properly assign diseased and healthy people by small but clinically purposeful genes. Feature selection is an essential to classify diseased and healthy people with the genes that not only small amount but also clinically purposeful. Contrariwise, it is a troublesome issue for machine learning operations. There are multiple criteria exist to define successful feature selection and cross-validation mostly in big data. Those are independent Validation dataset, Correct Cross-validation, using computational sources efficiently, proper feature selection and classification method for examining data. Motivation to improve the effectiveness of wrapper method, sequential feature selection, we used chosen feature space by multiple filter methods proposed in the Pareto Optimality based framework. Formerly we applied filter tests to three public gene-expression datasets on the Pareto-based framework and gained promising results regarding an ideal subset of the features. We aimed to carry that framework one more step further with a wrapper method. The new results show us to previous features space gained from filter methods can suppress drawbacks of wrapper method and can provide higher predictive accuracy with statistically meaningful part of data. Consequently, applying wrapper method after filter methods increase the overall gene selection efficiency in different limitations.

Okoli, Daniel

Factors influencing the adoption of online home based business among ethnic minorities in the UK: An Empirical research | CIS | Presentation

Ethnic minorities in most developed countries (including UK) are linked with high levels of entrepreneurship, and their businesses are confined to highly competitive, low margin sectors of the market. Extant Studies are showing that online businesses are a potential means for ethnic minority entrepreneurs to break out into better paying sectors of the market such as ... This research aims to investigate the factors that may influence ethnic minority entrepreneurs in adopting and running online home based businesses in the UK using quantitative analysis to explore the Understanding Society (USoc) dataset. This research contributes to a growing body of evidence on the need for more effective ethnic minority business support, policy decisions, and for people who plan to start and entrepreneurs who are running their online home based businesses.

Riachy, Chirine

Towards Effective Real-life Person Re-Identification | CIS | Poster

Person re-identification (Re-ID) aims at searching and associating people across cameras at different times and locations in an efficient and effective way. Due to its wide range of applications in mass surveillance systems and forensic science, it has been researched extensively during the last few years. Unfortunately, many system effectiveness and robustness related problems remain largely unsolved. In particular, accurate people matching across a network of cameras with non-overlapping fields of views underpins various challenges including variation in illumination and viewpoint angle, low-resolution visual representation, background clutter and occlusions. To test the performance of Re-ID systems, several benchmarking datasets are constantly being introduced and common evaluation metrics are employed. However, all reported studies fail to provide any results with statistical significance. Moreover, larger scale of datasets have been frequently emerging in recent years, but does a bigger size imply a more comprehensive performance assessment? When will this growth reach its limit or become statistically unnecessary? These issues have never been properly addressed in literature. In order to achieve comprehensive performance assessment, we are developing a novel methodology to systematically construct test collections with different complexity levels. Meanwhile, we are also designing a resampling scheme to generate evaluation results with statistical significance. The empirical results will provide effective insights and guidance towards the design of advanced feature to mitigate the effect of challenging dataset attributes.

Walters, Julie

Capturing useful information from Twitter for improving patient care in hospitals | CIS | Presentation

The management of patient experience and the management of patient expectations is at the core of many national policies throughout the UK (National Institute for Health and Care Excellence (NICE)). To allow hospital managers to understand the elements which create excellent patient experience it is essential the mechanisms are in place to capture patient feedback and experiences appropriately. There are a number of methods of collecting patient feedback currently in place, however previous research has recognised that the current methods could be improved upon particularly in terms of timeliness.

This study is focussed on exploring how Twitter can be used to capture useful information which could be analysed and used as a change agent to improve patient experience. The study is focussed on hospitals within Newcastle upon Tyne. The study is divided into 3 phases: firstly developing a method for extracting relevant tweets, then creating thematic groups for categorising tweets and from this creating a tool which can automatically categorise the tweets and extract smaller datasets related specifically to particular themes and sub themes.

The work to date has identified 15 key themes (e.g. food, entertainment etc). For each of these themes a corpus of words has been identified which would allow hospital managers to extract relevant data from Twitter which could then be used to inform hospital policy, with the intention of improving patient experience.

Geography

Bermingham, Adam

Determining the legacy of long-term anthropogenic impact on biodiversity and ecosystem services in Belize | GEO | Presentation

Understanding human-environmental interactions in Belize is fundamental to determine appropriate pathways for conservation strategies in modern ecosystems. In order to make decisions regarding how people should conserve and use the landscape, it is important to understand the impact past human societies had on their environment. In the context of Belize, the Classic Maya civilisation has been used as a case study to evaluate and discuss the relationship people have had with their environment in the past [1]. Contrasting hypothesis are evident when discussing the land management practices of the Classic Maya. Researchers argue that large scale episodes of deforestation are directly linked to a demographic decline around the 9th century AD[2], while others suggest that the pre-hispanic Maya participated in a range of activities that promoted an agroforestry type system[3]. This research will attempt to address the spatial perspective of the deforestation hypothesis while adding a valuable temporal perspective to the agroforestry hypothesis. **Aim:** The aim of this project is to investigate past anthropogenic influences on vegetation and to determine the legacy of these influences on the modern landscape of Belize. The methodology for this research will use a combination of empirical and statistical evidence. Fossil pollen and charcoal will be used to evaluate and interpret the history of land use in Belize while statistical packages such as the Multiple Scenario Approach and CharAnalysis will be used to address various limitations in the empirical evidence.

Burger, Flavia

Digital elevation model using Corona Satellite imagery to investigate glacier changes in central Chile | GEO | Poster

Glaciers are retreating significantly in the southern Andes, where water resources are vital for the populated areas, as central Chile. To improve our knowledge of glacier changes and future response in central Chile, it is valuable the use of satellite imagery.

This study used Corona KH-4A and high resolution Lidar digital elevation model (DEM) to generate a DEM of Bello glacier in central Chile of 1976. Corona imagery, are declassified satellite imagery from the 1960s and 1970s from the US intelligence satellite missions, which are an important tool for mapping historic extends of glaciers. In particular, for this study a subset area of one stereo pair of Corona imagery was used for the DEM generation. This work presents the methodology used to create a high quality DEM from Corona imagery in a complex topography.

Cullum, Michael

The Insignificant Ice Age: Can climate models simulate the Medieval Warm Period and Little Ice Age over Greenland? | GEO | Poster

The past 1000 years are defined by abrupt fluctuations in climate, in response to changes in volcanic and solar activity. These changes resulted in the Medieval Warm Period (MWP; ca. 950 – 1250) and Little Ice Age (LIA; ca. 1450 – 1850), where global temperatures varied by 0.5 - 1°C from present, with the largest changes confined to high latitudes.

On Greenland, climate observations rely on high-resolution, ice core data; however, their limited spatial coverage prevents continental scale reconstructions. To address is issue, climate models are utilised to produce spatially-robust climate reconstructions for the entire region. However, limitations in knowledge and technology mean simulations are simplified, and contain significant internal variability, associated with differing model physics. In response, an ensemble approach is frequently employed, with multiple models incorporating the same conditions to produce reconstructions which account for model dependant variations.

The study aims to determine how accurately models from the Paleoclimate Modelling Intercomparison Project 3 (PMIP3), simulate continental-scale climate change of the last millennium over Greenland, through robust statistical analysis of simulated temperature and precipitation data and comparison with observational records, to determine model error.

None of the PMIP3 ensemble accurately simulate Greenland climate throughout the MWP and LIA. Despite this, IPSL produces the most actuate temperatures, and CSIRO produces the most accurate precipitation. No models produce abrupt climate changes seen across the northern hemisphere, with each producing unique, yet stable trends, stemming from internal variability, forcings and feedbacks. Proxy reconstructions also fail to show warming/cooling episodes, suggesting that regional influence over Greenland dampened climatic variations. Indicating that current models are unable to consistently produce accurate conditions, reflecting the need for improved complexity to better reflect regional variations.

Dunlop, Lesley

Geomorphology of the Chalk Downlands of the west North Wessex Downs | GEO | Poster

The area of study is the North Wessex Downs, covering parts of Oxfordshire, Berkshire, Hampshire and Wiltshire, at the western end of the London Basin, a synclinal feature. Part of this research presents an updated geomorphological map of an area of about 500 km^2. The geomorphology of the region is re-examined in order to place into context some of the possible landscape evolution processes. The area has been mapped using a combination of high resolution digital elevation model (NEXTmap), geological, topographic maps and Google Earth images and for drainage basins and river courses ArcGIS spatial analyst tools are used, in particular, the hydrology toolset.

The bedrock in the area is Chalk, deposited between 95 to 80 million years ago and sands and clays of younger Palaeogene beds deposited between 65 to 50 million years ago. There is no record of deposition or erosion in the area between 50 million years ago and the beginning of the Quaternary at 2.6 million years and it has been described as a relict periglacial landscape (Te Punga, 1957). The landscape may be a result of base-level lowering, a regional fall in sea-level or changes in the physical properties of the rock during periglacial periods (Maddy et al, 2000, Murton and Belshaw, 2011).

The map highlights valleys, scarp slopes, extent of permanent water and those which are seasonal and spring fed. Surface features associated with periglacial features, such as infilled hollows and dolines, on the Chalk dip slope have been identified.

Hazell, Calian

SOCIETAL COLLAPSE! Climate or Primate? | GEO | Presentation

Between 4.2 and 3.2 thousand years ago during the Late Holocene, the Late Bronze Age societies of the eastern Mediterranean experienced two long and complex periods of politico-economic decline. The first resulted in complete societal collapse of the Akkadian empire and increasing desertion of the surrounding Assyrian towns, while the second resulted in the collapse of the Mycenaean, Hittite and Assyrian empires. Proposed causes include tsunamis/earthquakes, internal governmental collapse, civil inequality-based unrest, and external army invasion, and recent research has suggested a potential climatic cause.

Whether an Abrupt Climate Change (ACC) event was enough to cause the collapse is widely debated, and some archaeologists & climate scientists do not even accept that an ACC occurred at 3.2 kyrs BP.

Here I will present not only the palaeoenvironmental evidence for such an event, but will speculate on the potential forcing mechanisms that could have induced the ACC to occur, and how it could have indeed brought an end to western civilization.

Parry, Mark Ashley

Youth Engagement in Climate Change | GEO | Presentation

Climate Change is a widely recognised issue amongst both academia and civil society. Currently, research shows that although most young people believe that climate change is happening, the amount of active engagement with environmental organisation and climate change in general is low. This is surprising, as the current generation of young people are the first generation to have been brought up with climate change been an accept and fundamental issue in civil society. This has led to of some academic to describe it as the “climate spiral of silence”.

The adolescence period for young people is important in developing their perception about climate change. During the adolescence period, the human body undergoes many changes; most importantly to the brain. This cognitive development results in changes to their inhibition, risk-taking, wisdom and perceptions. This is the period, in which humans start to ask questions about the world around them, rather than accepting the beliefs from the ‘adults’; and therefore start to develop their own unique beliefs through their interactions with different social and cultural environments. However, more than ever this is dangerous, due to post-truth and fake news. This means that young people are more vulnerable in accepting sceptical beliefs and conspiracy theories about climate change. Therefore, teaching and giving young people an opportunity to discuss these issues amongst their peers is becoming increasing critical.

Playford, Lionel

Art and climate science in the Anthropocene: an artistic collaboration with palaeo-climate geography | GEO | Presentation

This presentation illustrates how a landscape artist, transforming embodied outdoor practice and a scientifically informed understanding of climate change processes into works of art, is generating new modes of visualizing the Anthropocene. The current research develops an artistic collaboration with scientists in the context of contemporary and historical geographical understandings of landscapes (Wylie 2007). It proposes that aesthetic concepts of Romanticism in landscape remain highly relevant to practices of contemporary art concerned with anthropogenic climate change and its consequences. The research is informed by cultural geographical debates which highlight situated, local, performative and embodied methods of landscape knowledge production, including those of field science.

The author's collaborations with scientists have generated novel artistic processes and outcomes ranging from responsive field drawing, using found materials and energies, to studio practice incorporating scientific instruments, inscriptions and data and transforming natural materials from the landscape into paper sculptures (fig 1). During a Leverhulme Trust residency with Northumbria University Department of Geography the author created speculative works of art (including paper 'clouds') based on his observation of peat coring and terrestrial laser scanning. These employed images of micro- fossil evidence of past vegetation and subjective, drawing-based experiences of present day climate change science research landscapes. These hybrid works were further informed by the systematic performance of *weather-world* drawing out in the peatlands of the North Pennines (fig 2).

The works of art described and the associated publications and exhibitions have contributed to the engagement of science with the general public towards a better understanding of climate change research.

Schwarz, Florian

The mid-Piacenzian warm period in the Asian interior: Assessing palaeoclimate variability with high-resolution pollen records from the Qaidam Basin and Kunlun Pass | GEO | Presentation

The climate of the Asian interior is controlled by the East Asian Monsoon providing warm and wet air directed north and westwards in summer, and cold and dry air directed south and eastwards in winter. During the mid-Piacenzian warm period (mPWP; 3.264 – 3.025 Ma) multiple palaeorecords indicate a strengthening of the East Asian Winter Monsoon (EAWM) whereas the response of the East Asian Summer Monsoon (EASM) is subject of controversy. Being the main source of precipitation for the Asian interior, it is of fundamental importance to understand the intensity and variability of the EASM during the warm Pliocene, which had climatic conditions similar to what climate models predict for the end of the 21st century. Our study reconstructs vegetation and climate changes during the mPWP from two sites located at the northwestern limit of the EASM (Qaidam Basin, Kunlun Pass) using high-resolution pollen records.

Preliminary results show that between 3.339 – 3.097 Ma the vegetation in the western Qaidam Basin (SG-1b drilling site) was dominated by xerophytic shrubland with Chenopodiaceae and *Artemisia* spp. usually contributing more than 50% of pollen grains. Broadleaved and coniferous trees usually comprise only a small fraction, however, they repeatedly reach 15-20% of the total pollen count during short intervals that represent wetter periods during the mPWP. Spectral analysis of *Artemisia*/Chenopodiaceae ratios as a relative precipitation proxy suggests that

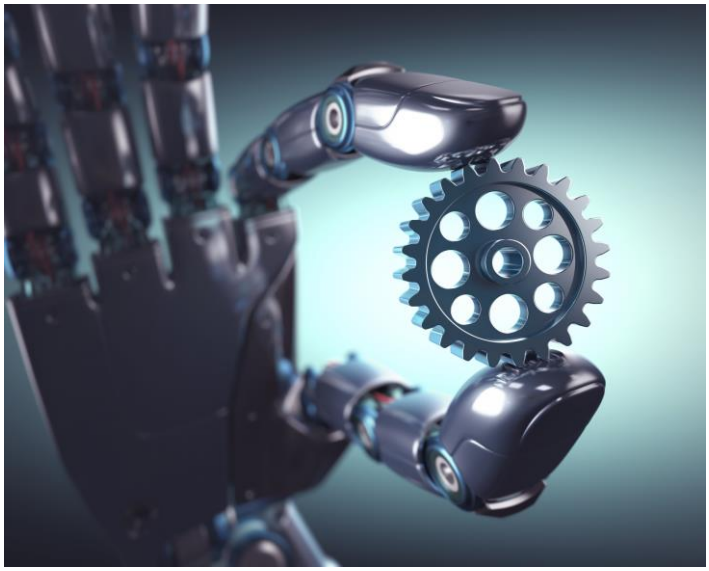
palaeoprecipitation changes are controlled by 41ka orbital cycles. A strong increase in coniferous tree taxa and pollen concentrations suggest a distinctly wetter phase around 3.17 Ma.

Todt, Markus

Simulation of longwave radiation beneath boreal forests | GEO | Presentation

CMIP5 models have been shown to underestimate both trend and variability in northern hemisphere spring snow cover extent, a substantial fraction of which is covered by boreal forests. Forest coverage shades the ground and enhances longwave radiation thereby impacting the radiation budget of the ground, which is dominating the snow energy balance in forests. Longwave enhancement is a potential mechanism that contributes to uncertainty in snowmelt modelling. Here we use radiation measurements from an alpine forest to assess the simulation of sub-canopy longwave radiation by CLM4.5, the land component of the NCAR Community Earth System Model. CLM4.5 overestimates the diurnal cycle of sub-canopy longwave radiation and consequently longwave enhancement.

Overestimation results from clear sky conditions, due to high absorption of shortwave radiation during daytime and radiative cooling during nighttime. Using recent improvements to the canopy parameterisations of SNOWPACK as a guideline, CLM4.5 simulations of sub-canopy longwave radiation improve through the implementation of a heat mass parameterisation, i.e. including the thermal inertia effect due to biomass. However, this improvement does not substantially reduce the amplitude of the diurnal cycle, a result also found during the development of SNOWPACK.



Mechanical & Construction Engineering

Alafogianni, Maria

Effects of varying laser trim pattern geometries on the performance of thin film resistors | MCE | Presentation

There is a high demand for cost-effective electronic devices with tolerances better than ±10%. The resistance value is usually adjusted with a variety of trimming methods. However, laser trimming is the most popular and effective method for the manufacturing of thin and thick film resistors with tolerances less than 1%. In general, resistors are fabricated to lower resistance values than needed and then the value is increased towards the target by trimming away sections of the material. In this current study, the effects of varying laser trimming geometries on key performance parameters of bar shape thin film resistors are investigated. Several popular trim patterns including the plunge cut, double plunge cut, L-cut and scan cut as well as two novel patterns; the curved L-cut and semi-circle were modelled and tested experimentally. The effect of these geometries on target resistance value, heat-affected zone (HAZ) sensitivity and temperature coefficient of resistance (TCR) were analysed. It is found that variation in trim length, within the range of 5 up to 15 mm, can give significant increases in the TCR of the thin films compared to untrimmed parts. For instance, the initial value for the TCR of the untrimmed part is 2.91 ppm/°C and for the plunge cut can reach up to 11.51 ppm/°C. In addition to this, the value of TCR for the double plunge cut can reach up to 14.34 ppm/°C and for the curved L-cut up to 5.11 ppm/°C.

Aldeeb, Tareg

Nonlinear fatigue damage analysis using Rainflow method | MCE | Poster

The mechanical parts of machine can fail under cyclic loading; usually these stresses can be defined as constant amplitude (CA) or random amplitude (RA) histories during their lifetime. This behaviour known as material fatigue, to analysis this phenomena two theories with the help of Rainflow Tanique of extracting cycles, are introduced during the mid-20th century, linear and nonlinear fatigue damage accumulations. This poster present the steps needed to get accurate results using nonlinear fatigue damage accumulation especially when random loading is considered. Cycles can be counted with Rainflow algorithms and the damage was cumulated with new model proposed. This proposed model will be compared with literature study to evaluate the accuracy of this modal.

Alhiddi, Ahmed

Organizational Culture and Stakeholder Success Criteria: A Structural Equation Model and Construction Project Management Success Framework | MCE | Poster

The research aims to develop and explore the validity of a hypothesized Structural Equation Module (SEM) which explains the association between the constructs of organizational culture and stakeholder success criteria in construction-related projects. The objective is to formulate a Construction Project Management Success Framework (CPMSF) through the empirical examination of the relationships between two core elements of CPMSFs: organizational culture and stakeholder management. Following a review of key literature, constructs explaining the factors associated with organizational culture and stakeholder management in CPMSFs have been conceptually identified and defined.

Following a review of published work, it is understood this will be the first research project to adopt a holistic approach to study seeking to associate and investigate the relationship between the two core elements of CPMSFs, and hence, to determine which category of organizational culture is most relevant to the associated category of major project stakeholders. This uniqueness is extended to the specification of a hypothesized SEM explaining the association of the constructs of a CPMSF.

Understanding the nature, power, and direction of these relationships will provide future support to CPMSFs by assisting organizations to realize and demonstrate the requisite culture type to support and sustain associated stakeholders, and likewise which culture type may impede stakeholder success.

The philosophy and research goals of the investigation have influenced the adoption of mixed research methods within a case study approach. This strategy will enable the investigation to consider 'how' and 'why' stakeholders interact in certain ways and if their behaviour corresponds to pre-defined cultural drivers. The cases to be examined will be major construction projects that have multi-organizational cultures and stakeholders.The research methods to be adopted during the first stage of the investigation will include questionnaire and interview surveys, and a desktop study of project-related documentation. This will pave the way for the second stage, which will inform the development of probing questions for semi-structured interviews with expert informants. IBM SPSS and NVivo will be used to structure the primary data and IBP SPSS Amos Graphics to investigate the SEM specification.

Edmondson, Vikki

A non-contact technique to evaluate skid resistance for asphalt pavements | MCE | Poster

Skid resistance has been related to the microscale texture on the surface of road aggregates in the range of 0.001mm to 1mm (Dunford and Viner, 2006). In addition the gaps in between aggregates, known as the macrotexture, can influence the way wet skid resistance reduces with increasing speed (Dunford, 2013), being understood to act to disperse water.

Standard techniques to measure skid resistance, the Sideway-Force Coefficient Routine Investigation Machine (British Standards Institute, 2006), Grip Tester (British Standards Institute, 2000) and Pendulum Tester (British Standards Institute, 2011) are susceptible to seasonal variation as a consequence of the sensitivity of rubber resilience to temperature change (Hosking and Woodford, 1976) with survey results requiring statistical interpretation (Plati *et al,* 2014; DMRB HD28/15). These current techniques have the disadvantage of being incompatible with the SCANNER high-speed road surface condition surveys (Werro *et al,* 2010) and measurements are susceptible to changes in travel speed (Dunford, 2008).

The ability to measure highway surface texture with a non-contact method at the microscale (below 1mm) will support progressive monitoring of highway surface deterioration; and also has the potential to improve existing skid resistance measurement techniques, first developed in the 1960s (Giles, 1957; Giles *et al,* 1964).

Recently with the interest in the research and development of autonomous vehicles, the ability to accurately measure skid resistance by a non-contact method has further promising applications.

Etaig, Saleh

Heat Transfer Performance And Flow Characteristics Of Magnesium Oxide-Water Nanofluid In a Horizontal Triangular Cross Sectional Microchannel | MCE | Poster

Recent developments in nanofluid applications and the approaches for improving cooling technology for electronic equipment with higher heat application have attracted the need for possible production of efficient and compact cooling components. In this work, a three-dimensional model of heat transfer performance and fluid flow characteristics in horizontal microchannel with triangular cross section with a hydraulic diameter of 130 µm and a working fluid of magnesium oxide water nanofluid is developed and analysed numerically. A range of volume fractions was tested and different Reynolds numbers were investigated. It was found that the heat transfer improved remarkably with the increase in the volume fraction, and Nusselt number has a much higher value at the microchannel entry. The effective viscosity is calculated using a recent developed model and the results are shown and in line with the temperature change along the microchannel wall. It was found that the viscosity is augumented with the rise in volume fraction suspension. This augmentation was up to 25.5% when 6% volume fraction was tested compared to water The pressure coefficient and the shear stress were investigated in the present work and it was found that they increases with the increase in the volume fraction, which can be assumed a slight penalty of using nanofluid.

Hayes, Samuel

Rapid Arctic Coastal Change: Observation and Modelling | MCE | Presentation

Arctic coastlines are currently described as being in a state of collapse, with recent dramatic shifts to both the sea ice dominated marine, and permafrost dominated terrestrial, domains culminating in rapid changes to the coastal environment. Retreat rates have more than doubled in some locations over the last few decades, with reports of seasonal local retreats in excess of 40m just last summer. Indeed, as the climate warms over the coming century the effect on the Arctic permafrost coasts are expected to grow. However, despite the massive resulting impacts on both the coastal environment and the local communities, our understanding of the factors governing the variability in coastal retreat and of the failure mechanisms that result in large scale mass wasting events are still limited.
This research seeks to improve our understanding of Arctic coastal process through the application of multiple novel techniques with a focus on the Northwest Territories, Canada. Several observational methods are being applied and developed in order to perform high-resolution 3D change detection and thermal monitoring of the shore face. A numerical modelling approach, capable of simulating both the brittle and ductile nature of permafrost as it thaws and the influence of varying environmental forcings, is being utilised. In addition, detailed laboratory based physical modelling is being employed to aid the calibration and refinement of the numerical model. Taken together, these approaches should provide fresh insights into the factors governing Arctic coastal change.

Lopez, Isbelis

Mechanical characterization of protective coating with application in the offshore wind turbine industry | MCE | Presentation

The corrosion protection of metals has long been achieved by the use of coatings, especially organic coatings. Their principal function is to act as a physical barrier by tightly adhering to the metal and preventing contact with corroding agents. Organic coatings such as epoxy-based paints develop residual stresses in all stages of their life; excessive residual stresses affect adhesion and can compromise the integrity of both the coating system and substrate. Young's modulus is a crucial property for understanding the mechanical behaviour of a coating applied onto a substrate to provide corrosion protection. Several methods have been developed to determine Young's modulus and residual stresses of films. Three epoxy-based paint systems used in the protection of offshore wind turbine towers and transition pieces have been studied. Dynamic mechanical analysis, using 3-point bending mode, was performed in coatings airless-sprayed onto spring steel substrates. A mathematical model based on beam theory was used to determine Young's modulus and residual stresses of the coatings. The results show that the mechanical properties and residual stresses depend on the film thickness. The composite modulus and Young's modulus of the coatings decrease when the coating thickness increases. Understanding the mechanical properties of marine coatings, and the factors which influence them, could lead to further improvements in the coating and corrosion protection of offshore structures in general.

Parkin, Neil

An investigation into the influence of Trust on the sharing of Practical Knowledge in Technology Producing Small to Medium Enterprises (SMEs) | MCE | Poster

In general terms, academic research on Practical Knowledge has acknowledged the importance of trust, for example, Orlikowski, (2002) comments that socialisation processes build trust, credibility and respect and is one of the key enablers for sharing Practical Knowledge. Despite the important role of trust in the sharing of Practical Knowledge as indicated, this area has not been addressed by academic research.

Based on a review of the literature in the areas of areas of Trust Development, Collaborative working in SMEs and Practical Knowledge Sharing, a tentative Trust based Practical Knowledge Sharing Framework is presented. The Research Methodology, which takes an Ethnographic Case Study approach, which uses Semi-Structured Interviews to collate qualitative data about explicit and tacit Practical Knowledge sharing experiences, is described. In addition, the main challenges faced when developing the Data Collection and Analysis process and associated research instruments during a Pilot study, which has been conducted are then outlined.

Whilst the main practical work has just started with Case Study companies, it is anticipated that the following outcomes will be delivered:

- A framework will be formulated with associated empirical phenomena that outline how trust influences the sharing of Practical Knowledge.
- Best practice guidelines for Engineering Practitioners that consider trust based behaviours when sharing Practical Knowledge in different organisational settings.

Implications for SME personnel and Policy Makers.

Puzas, Victor

Copper rich metallic glasses composites for antimicrobial touch surfaces | MCE | Poster

The impact of infections transmitted by touch or nosocomial infections on medical costs and hospital stay has increased during the last decade. To tackle this issue, the application of chemicals has been the leading method for disinfection of large surfaces. This solution has led to considerable financial resources used to ensure an acute sterilization of healthcare facilities. At the same time, continue use of chemicals like chlorine has shown an increase in bacteria resistant to common disinfection. As a result, antimicrobial materials with self-sterilization properties are regarded as an appealing alternative.

Copper is a well-known material useful for its antimicrobial behaviour, therefore Cu-rich alloys have multiple potential applications in the healthcare industry. Nevertheless, copper is a soft material and therefore its use in many surface engineering applications is limited by the low tribological performance. An appealing technique to optimize the antimicrobial and wear resistance of metallic alloys is to develop metallic glass composites by tuning the nature and volume fraction of crystalline phases.

In this poster, the possibility of tuning the wear and antimicrobial performance of a Cu-rich metallic glass composite is explored by changing the volume fraction of crystalline phases.

Sun, Ansu

Rapid Prototyped Intraocular Lens Mould for Biomedical Engineering Application | MCE | Poster

The 3D printing technology, as being predicted as an efficient tool in future manufacturing, has been successfully prototyped many engineering products (Gross et al., 2014). In this research, we focus on prototyping the intraocular lens mould for the potential bio-medical application. After scoping the commercial products, we acquire the geometry database to establish the mould design in solidworks. Different designs are achieved, open loop, monobloc-plate, also we designed some special types (Erie, Bandhauer and McLaren, 2001). By using "Objet30" 3D printer (Berman, 2013), we successfully prototyped the moulds for different lens structure with diameter of 6 millimetre for optical part and 13 millimetre for whole lens. With considering the effects from the printing resolution to the optical property, we found a printing accuracy of 50 – 100 micrometre for "Objet30" 3D printer, for the initial size required larger than 1 millimetre. The acquired printing accuracy may effected our part geometry and size. Therefore, we are still working on the optimisation of the printing techniques, as well as the lens structure design. On the other hand, printed moulds were injected gel polymer to manufacture intraocular lens. We will adopt the practical gel synthesis factors and optical testing results for further improve designs, and fabrication methods for achieving 3D printed moulds with more convenient route for downstream applications.

Wang, Cong

Super-flexible strain Sensors with Stepwise Deformation Sensing technique | MCE | Presentation

Flexible electronic and MEMS devices have become one of the more interesting technologies for next generation applications such as bio-medical electronics, flexible circuits, sensors and actuators. Recent development has shown that elastic substrates have great potential to withstand high strain deformation during bending, compressing and stretching, when complying with local features such as metal interconnects and integrated transducers

Developing MEMS sensors with a high strain sensing range (up to 0.6) and a stepwise sensing mechanism could enable widespread downstream applications, by allowing intimate, mechanically conformable integration with soft biological tissues. Most approaches to date focus on challenges to associate the sensing mechanism with high peak strains under large deformation.

By designing and characterizing the flexible sensors with multi-switching electrodes on super-flexible substrates, this research has established a strategy for stepwise strain-sensing mechanism and presents a concept in which elastomeric substrates with engineered distributions of a set of materials and structural characteristics yield stepwise strain sensing of in-plane deformations. The growing and co-existence of wrinkles and creases on multiple electrodes with different dimensions are observed under lateral strains ranging between 0.3 and 0.6. The two stage resistance value change has been demonstrated and observed under changing compressive strain. The related technologies and newly developed sensing mechanism could shed a light on the future applications in tunable optics and stretchable electronics.

Wang, Ding

Formation of harmonic wrinkling and multi-scale surface evolution guided by structural confinements | MCE | Presentation

Functional surfaces with micro-structures are naturally existed, such as claw skin of gecko, lotus leaves, butterfly wings. The multi-scale and hierarchical micro-/nano-structures offer an enhancement on mechanical property as well as other special functionalities, *i.e.*, wettability, structural colour, or dry adhesion. Traditional methods of fabricating such surfaces normally consider microfabrication technologies only, which are only applicable to specific substrates and are difficult to scale up and implement on curved surfaces. By taking advantage of a mechanical instability on a Polyelectrolyte gel or elastomer film, hierarchical instability patterns could be generated on both flat and curved surfaces spontaneously with response to various external stimuli such as mechanical compressive stress, light, temperature, electric potential, magnetic, etc. In this project, we have designed and fabricated a bilayer structure, with a patterned surface consisting of voids, which is capable of behaving mechano-geometrically surface re-shaping (wrinkling, creasing, etc.) after plasma treatment. Guided by micro-patterns, we unveiled the oblique/curvedly formation and evolution of elastic instabilities with on the elastic surface. AFM results identified a nice winkling and further development of the instability on the surface. The above findings are disruptive and original, the oblique formation of instability yield a directional capillary force and resulted the bi-directional droplet shaping, to form a strategy of developing a super hydrophobic pattern for oil-field application.

Young, Nicola

Transitioning MSc Research to a PhD to develop a conceptual guidance framework outlining governance methods to support public sector digital projects | MCE | Presentation

My MSc research (Young, 2015) found continued use of what is seen as restricted governance and approvals for agile projects had caused perceived issues in the successful use and application of agile in the public sector.

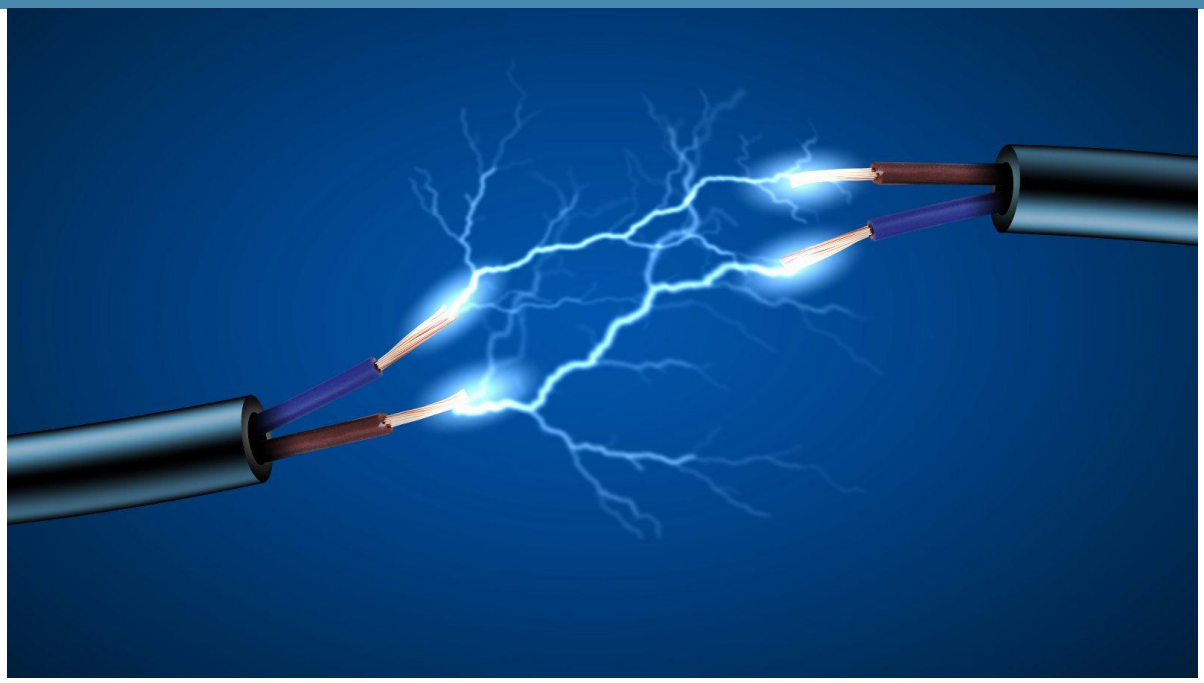
To advance my MSc recommendations, I continued researching on an informal basis and found no solution or answers that would satisfy the needs of my organization.

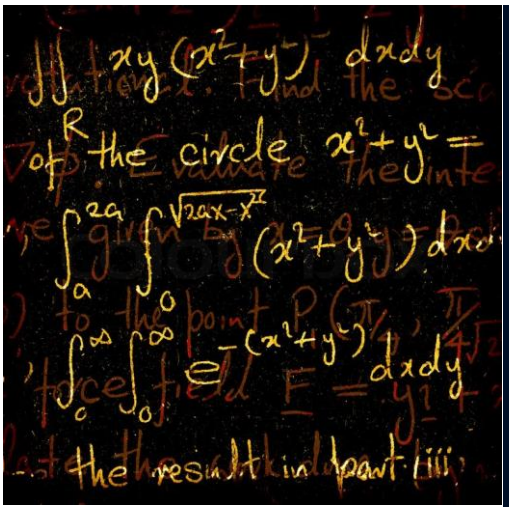
Reviewing literature found only one primary reference in the form of one of four governance paradigms developed by Muller (2009): an agile pragmatist paradigm for projects. Muller (2009) contends this paradigm results in a governance framework that is 'more process and control orientated, stressing the need for planning and plan conformance, a process discipline and clear lines of responsibility' (Muller, 2009, p.65). Comparing Muller's definition of an agile pragmatist paradigm to the agile manifesto identifies a contradiction against two of the primary statements:

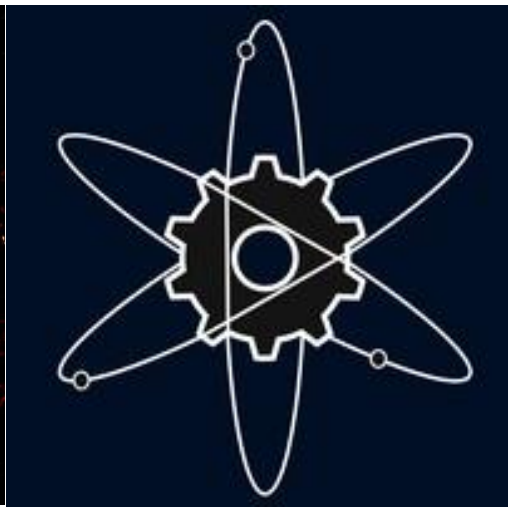
'Individuals and interactions over processes and tools'; and 'Responding to change over following a plan' (Beck et al., 2001).

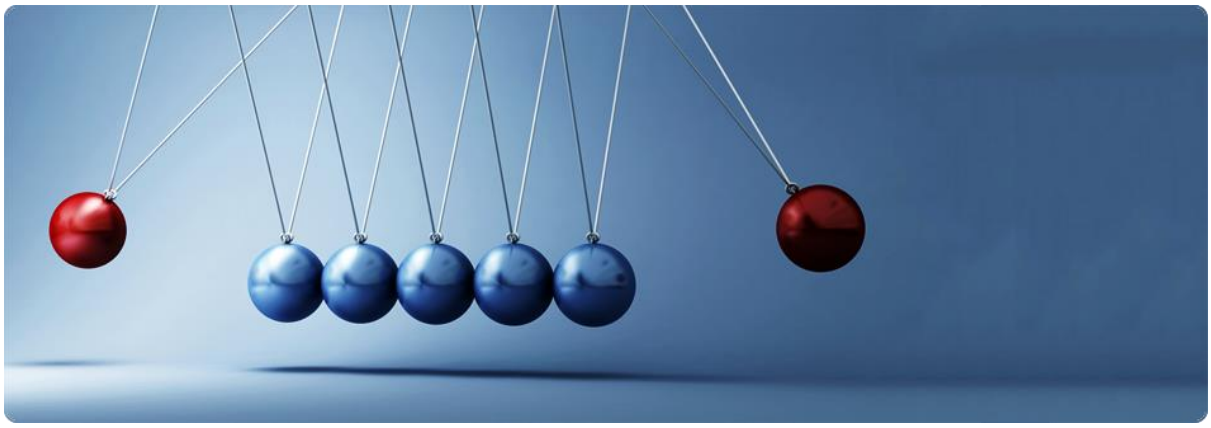
Comprehensively searching current literature of the phrase 'agile pragmatist paradigm' found little development of this paradigm and its underpinning principles, other than those involving Muller himself thus, offering an opportunity for detailed research in this area.

I will tell the journey of my investigations; explain how I am using the findings from my MSc to refine my PhD topic including journal development; research and data collection methods; and, share how I balance a part-time PhD with a full-time project role in the public sector.









Mathematics, Physics & Electrical Engineering

Abdelmoteleb, Mariam

LED-to-LED Visible Light Li-Fi system | MPEE | Poster

Light Fidelity (Li-Fi) is considered the new complementary technology in indoor environments for Wi-Fi and RF based communications. It aims to connect devices and provide internet access via the readily available visible light from light emitting diodes (LEDs), saving thereby power consumption and benefiting from the cheap and high speed properties of light as an information carrier. However, Li-Fi based communication devices need to be equipped with both an LED and a photodetector, unlike RF communication devices, which rely on a single antenna for transmission and reception.

LED-to-LED communication aims to use a single LED as both a transmitter and a receiver in a time-multiplexing manner. Since the *p-n* junction structure of an LED resembles that of the photodiode, the main objective of the project is to investigate the feasibility of the LED as receiver and to implement and optimize an LED-to-LED communication system. Thus far, a simplex LED-to-LED communication system based on Arduino has been implemented using white RGB LEDs, with successful data transmission and reception at a distance of 2 cm and data rate of almost 1 kbps. Not only does an RGB LED provide white light for lighting, but it also allows wavelength division multiplexing by sending different data on the three different colours (red, green and blue). As a receiver, each LED colour detects a different wavelength better, which eliminates the need for filters. LED transmitter and receiver arrays are then used to increase the power and thereby the distance and the illumination intensity.

Ahmad, Nik

Thermally Evaporated Antimony Selenide Thin Film for PV | MPEE | Poster

Antimony Selenide (Sb_2Se_3) is one of the newest emerging material currently under research to be used as an absorber material in thin film solar cell. Unlike other thin film solar cell, such as those based on CIGS, CdTe and Perovskites solar cell, Sb_2Se_3 is earth abundant, non-toxic with a band gap ranging between 1.0 eV to 1.2 eV and high absorption coefficient at 10^5 cm^{-1} [1,2]. These properties make this material a suitable contender for deployment as thin film PV, if device with high conversion efficiency are achieved. In this study, Sb_2Se_3 thin films were grown by conventional thermal evaporation method at room temperature. Samples were then annealed at temperature ranging from 100 °C to 250 °C and characterised by scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), X-ray diffraction (XRD) and UV-VIS-NIR spectroscopy. It was found that Sb_2Se_3 crystallises in an orthorhombic crystal structure and a space group of PNMA 62 with peak dominated at (211) and (221). The grain size ranges from 30-40 nm with no noticeable increase in the grain size with increasing annealing temperature. The optical band gap lies in the range of 1.12 ± 0.02 eV where this value is in agreement with previously reported study.

Al-Karakchi, Ahmed

Control Charging Profiles to Extend Battery life | MPEE | Poster

The effects of environment pollution, climate change, and extensive use of fossil fuel for transport are driving the trend to replace internal combustion engine vehicles by electric vehicles (EV). EVs have many advantages, such as reduced pollution and noise. One of the main concerns regarding the increased deployment of EVs is the effect on the grid, mainly increased power demand. In contrast, EVs can provide opportunities to support the grid. For example, if EV charging is controlled (smart charging), this could reduce peak demand and improve grid efficiency. Further, the EV may be used as storage to provide ancillary services to the grid, e.g. frequency control. Implementing these services can impact battery cycle life and performance, which are the main barriers for wide spread of EVs. Throughout their life and cycling, there are several factors that affect the performance and capacity fading of Li-ions batteries.

This work focuses on analysis of EV charging patterns to define the main factors that affect battery life. Comparison of different charging patterns and their impact on battery state of health will be presented. The standard charging of lithium ion batteries follows constant current and constant voltage strategy, which satisfy user and safety requirements but not necessarily the optimum strategy to limit battery degradation. The poster will present the experimental work conducted by the authors which includes standard charging profiles and modifications to the standard pattern which result in improving battery performance and working life. The results show a noticeable improvement in battery life by reducing capacity degradation and lowering the rate of increase of the internal resistance of the battery (thus improving battery power capacity).

AlMusawi, Hassan

Performance Enhancement of 4G-LTE Hybrid RoMMF-FSO System Using Mode Filtering Technique | MPEE | Poster

This work proposes an optimum hybrid radio over multi-mode fibre and free space optics (RoMMF–FSO) system to enhance the last mile bottleneck issues of wireless communication systems. A single mode filtering technique (SMFT) is used to optimize the system performance by mitigating the modal effects produced by multimode optical fibre networks. We characterize the system based on the beam profile, transfer function, and error vector magnitude (EVM) measurements. Results demonstrate the robustness of the proposed scheme in terms of increased available passband bandwidth by 2 GHz and improving the transmission shape by reducing the system transfer function ripple by more than 5 dB. Moreover, the proposed system enhances the EVM by 4% and improves the received optical power by 13.6 dB. Successful transmission of the 4^{th} generation-long term evolution (4G-LTE) signal with 67 Mbps data rate is achieved over a MMF-FSO channel with a 1.5 dB power penalty with respect to the LTE EVM limit of 12.5% as is specified for 16-quadrature amplitude modulation (16-QAM).

Bridgewater, Adam

Mathematical investigation of diabetically impaired ultradian oscillations in the glucose-insulin regulation | MPEE | Presentation

The accuracy of the oscillatory nature of the glucose and insulin blood levels constitutes an important indicator of healthy regulation [4]. In this contribution, we study a mathematical model which incorporates two physiological delays, as well as parameters representing diabetic deficiencies, in order to investigate the impact of a fault in the glucose utilisation on the production of ultradian oscillations in the glucose-insulin system. The delays represent the hepatic glucose production and the time necessary for the release of insulin, and have been shown to be at least partly responsible for the oscillatory nature of the regime [2,3]. A numerical study of the non-linear mathematical model is performed to characterise the onset of the oscillations, and perturbations of the periodic solutions are used to investigate the amplitude and frequency of the oscillations. Through use of linear stability analysis and bifurcation theory, pathways to restoring appropriate cyclic regulation are mathematically described [1]. Our goal is to provide measurable indicators of deficiency in the system and a more thorough description of the contribution of insulin treatments to the reintroduction of an oscillatory behaviour which is crucial for the design of a control algorithm which could then be implemented into an insulin control system.

Campbell, Stephen

Low temperature photoluminescence spectroscopy and IV measurements for analysis of Cu_2ZnSnS_4 nanoparticle inks and $Cu_{22}ZnSn(S,Se)_4$ solar cells | MPEE | Poster

Kesterite solar cells fabricated from Earth-abundant, non-toxic elements have attracted considerable attention to-date. One compound in particular, $Cu_2ZnSn(S,Se)_4$ (CZTSSe) has a high absorption coefficient in the visible region of the electromagnetic (EM) spectrum and a near optimal bandgap for photon absorption making it suitable for thin film absorber layers. CZTSSe films produced from nanoparticle inks offer a low cost solution-based method of fabrication without the processing use of highly volatile and toxic solvents such as hydrazine. Currently, a record nanoparticle-based device performance of 9.3% has been achieved for selenised CZTSe absorbers [1]. However, the open circuit voltage V_{oc} deficit remains the major obstacle to achieving higher efficiency in CZTSSe cells. An in-depth analysis of the absorber material and its related interfaces is required in order to identify, understand and resolve the cause of the sub-optimal performance of CZTSSe-based solar cells. In this study, a number of characterisation and analytical techniques will be used to study the behaviour of CZTSSe absorbers and solar cells in order to identify, understand and resolve the cause of the sub-optimal performance of CZTSSe-based devices. Fig. 1 shows the excitation power-dependent photoluminescence emission from a CZTSSe absorber at 7 K. A bandgap of 1.05 eV for this absorber material was determined from external quantum efficiency (EQE) data. It is evident from the emission spectra that radiative recombination occurs around 0.85 eV, a value well below the bandgap energy. This is indicative of defects states within the bandgap of the material, which contribute to a low V_{OC}. Similar results are seen in hydrazine-processed CZTSSe absorbers [2]. Temperature-dependent dark current-voltage measurements IV(T) can also be used to determine the barrier height Φ_{BH} of the back Schottky (metal-semiconductor) contact. The height of this barrier in solar cells can inhibit carrier extraction and impact on device performance. Fig. 2 shows the temperature dependence of the series resistance R_S (extracted from IV(T) data) for a CZTSSe solar cell. The estimated value of Φ_{BH} is 24.8 meV and is comparable to Φ_{BH} values determined in other studies.

Druett, Malcolm

Non-thermal hydrogen Balmer and Paschen emission in solar flares generated by electron beams | MPEE | Presentation

Sharp rises of hard X-ray emission and chromospheric line profiles with strong Doppler red-shifts, observed at the onset of solar flares, are not fully explained by existing models. Moreover, continuum emission reveals strong co-temporal enhancements, co-spatial with HXR emission. This suggests a fast effective source of excitation and ionisation of hydrogen atoms associated with HXR emission. We investigate electron beams as agents accounting for these observations.

A 1D hydrodynamic response to the electron beam simulates the flaring atmosphere's kinetic temperatures, densities and macrovelocities. A radiative response in these atmospheres is produced using a fully non-local thermodynamic equilibrium approach for a 5 levels plus continuum hydrogen atom model. Excitation and ionisation is considered by spontaneous, external and internal diffusive radiation and by inelastic collisions with thermal and beam electrons. Simultaneous steady state and integral radiative transfer equations (in optically thick transitions) are solved iteratively for all the transitions.

Inelastic collisions with beam electrons strongly increase excitation and ionisation of hydrogen atoms from the chromosphere to photosphere. This leads to increased Lyman continuum radiation, which governs hydrogen ionisation

and results in great enhancement of Balmer and Paschen continuous emission. Height distributions of contribution functions for Paschen continuum emission agree with observations of heights of WL and HXR emission reported for limb flares. This process also increases wing emission in Balmer and Paschen lines, which is superimposed on large red-shifted enhancements of line emission resulting from downward motion by hydrodynamic shocks. Simulated line profiles closely fit the observations for different flaring events.

Fu, Yichuan

Modelling of Doubly Fed Induction Machine for Offshore Wind Turbine Systems | MPEE | Presentation

In recent years, some different topologies of doubly fed induction machines (DFIM) are widely utilised in wind turbine systems for the state-of-the-art. However, wind turbines are sophisticated and prone to faults which can cause breakdown. Furthermore, these faults or malfunctions can directly threaten the physical characteristics and performance of DFIM, which should be taken into considerations. Based on this reason, the 2D machine model has been built with use of software MagNet, which can be analysed the characteristics and machines' behaviour based on finite element method (FEM).

Guan, Jian Hui

Drop transport and positioning on lubricant-impregnated surfaces | MPEE | Presentation

Lubricant-impregnated surfaces (LIS) have been shown to exhibit excellent water-shedding performance with droplets placed on these surfaces having highly mobile contact lines. These surfaces enable droplet mobility and propulsion studies due to the removal of direct contact between the droplet and the underlying solid surface. Here we demonstrate the transport and positioning of water droplets on macro-patterned surface, impregnated with a lubricating liquid using a nano-particle based superhydrophobic coating. We achieved droplet self-propulsion using shallow V-shaped channels rendered as LIS. We found that a migration of droplets arises from the interaction between the droplet and the lubricant layer via a capillary mechanism similar to the Cheerios effect. Out of equilibrium droplets self-propel to different types of equilibrium positions on the surface with both local and global equilibriums being observed. We provide a capillary-based mathematical model to quantify the transition from local to global equilibrium and show that the latter is due to a force balance along the apparent contact line of the droplet. Beyond the V-shaped geometry, we also highlight possible applications where lubricated macro-patterned surfaces can be used to control the motion and positioning of droplets.

Hasan, Sameer

Flexible ZnO thin film based SAW devices for sensing applications | MPEE | Poster

Surface acoustic wave (SAW) devices have been widely used in variety of applications including sensing and microfluidics. However, SAW bio-sensors based on ZnO thin film exhibit high performance and sensitivity, in addition, they can be integrated into different lab-on-a chip micro-array platforms making them good candidates for wearable and point of care (POC) devices. Flexible thin film SAW devices have flexibility to be bent and deformed easily when deposited onto flexible substrates such as foils, thin glasses and polymers, hence, they can be fitted to various surfaces with different shapes and structures. In this project, high quality ZnO thin films were deposited on commercial low cost aluminium substrates with dominant *C*-axis orientation corresponding to ZnO (0002). A new mask with varied wavelengths and interdigital transducers (IDTs) configurations was designed for the use of SAW devices fabrication where electrodes were patterned on the flexible substrate by lithography process. Reflection (S11) and transmission (S21) scattered signals were analysed to identify the resonance frequencies, the vibration modes, the insertion losses and the electromechanical coupling coefficients. Finally, flexibility and sensing performance were demonstrated by using these devices for temperature, strain and gas sensing. The results showed a good potential for flexible SAW devices to be employed as sensing elements for the detection of biochemical and physical parameters.

Haspolat, Emrah

Deterministic and Stochastic Stability Analyses and Observation Design of Arabidopsis Flowering Model | MPEE | Presentation

In this work, we consider the deterministic and stochastic delayed non-linear dynamic model of Arabidopsis flowering time following the deterministic model introduced in [1]. By using the decoupling method, the system is reduced by focussing on the transcription factor Suppressor of Overexpression of Constants 1 (SOC1) and important floral meristem identity genes, Leafy (LFY) and Apetala1 (AP1). We consider three motifs from the reduced network, based on LFY and AP1, leading to simplified models of the GRN.
We investigate the steady state regimes analytically and numerically of the full model and reduced models and study the effect of stochasticity on the steady state regimes. The advantage of this approach is based on the realistic description of gene effects and gene interactions on flowering of Arabidopsis. New sufficient conditions of mean square stability are obtained analytically for these models using a Lyapunov function. Numerical investigations of the stability are performed with respect to gene concentrations and noise term. It is concluded that the stochasticity can change the behaviour of the stability region which cannot be obtained in the case of deterministic model of the Arabidopsis. Finally, a high gain observer of this dynamic model is introduced to estimate gene concentrations that cannot be easily measured experimentally. The models contribute to better understanding of the role of LFY and AP1 in Arabidopsis flowering.

Ishwein, Zahra

Hydrothermal growth for Zinc Oxide nanorods | MPEE | Poster

Since the early 1960s, synthesizing ZnO thin films has been a very active field because of the possible ZnO applications in transducers, photocatalysts, and sensors. In the last decade, increased interest has been regarding the study of nanostructure materials in 1D form, especially in the field of nanotechnology and nanoscience [1]. 1D ZnO nanostructures are considered to be one of the most facilitating structures due to the physical and chemical properties that they possess, leading to applications in optoelectronic, electronic, electromechanical, electrochemical devices [2]. For example, increasing the conversion efficiency of a solar cell is a driving force in research; one route to achieve this is using light trapping systems and randomized texture interface, which in turn will significantly increase the effective optical path length, therefore increase the opportunity to absorb incoming light inside the solar cell[3].

In this preliminary study, solution-based growth method was conducted to grow 1D ZnO nanorods (NRs) structure on an ITO-coated glass substrate. ZnO NRs were synthesised by a simple hydrothermal method. Different seed layer thicknesses were deposited on ITO substrate in order to control the growth process. 2 hours' growth time was used at three different temperatures (40°C, 60°C and 85°C), one of which is shown in Fig. 1. The results on the effect of temperature and seed layer thickness were investigated and will be reported. The resulted nanostructures were characterised using scanning electron microscope (SEM) to study morphology, X-ray diffraction (XRD) to investigate the crystallinity of the deposited ZnO and UV-VIS-NIR spectroscopy to study the reflection and absorption of the resulting NRs. From UV-VIS-NIR transmittance spectra, it was observed that, as the temperature increased, the transmittance decreased partly due to increased haze. Growth parameters are key to determining the growth characteristics (length of the resulted NRs and average diameters)[4]. If controlled repeatedly, this method has the potential to offer low-cost and large-scale structures for thin film photovoltaic applications.

Kumar, Rahul

High sensitivity temperature sensor based on a polymer filled hollow core optical fibre interferometer | MPEE | Poster

A high-sensitivity temperature sensor based on a singlemode-multimode-polymer filled hollow core fibre-multimode-singlemode (SMHMS) fibre structure has been proposed. This sensor was made from a short section of hollow core fibre filled with a high thermo-optic coefficient (TOC) polymer with a refractive index close to that of the fibre cladding, fusion spliced between two singlemode-multimode (SM) fibre structures. This sensor effectively improves the temperature sensitivity by over 200 times as compared to the conventional singlemode-multimode-singlemode (SMS) fibre structure. In this report, we experimentally demonstrate that the proposed sensor provides large temperature sensitivity of 2.16 nm/°C.

Lalam, Nageswara

Innovative distributed optical fibre sensor system for structural health monitoring applications | MPEE | Presentation

Distributed optical fibre sensor based on Brillouin scattering is a promising technique for structural health monitoring. The proposed sensor system can be effectively applied for accurate structural monitoring, such as dams, buildings, bridges, aero-planes, wind turbines, oil/gas pipelines. An installed optical fibre along the structure can able to monitor the temperature and strain in real-time up to several tens of kilometers.

We proposed an innovative wavelength diversity technique employed in distributed fibre sensor system to improve the measurement accuracy significantly. The proposed system has a sensitivities of 0.06 MHz/μ-strain and 1.25 MHz/°C, respectively. The research results will extensively improve the high standards of structural safety with high measurement accuracy in cost-effective way.

Lei, Zhefeng

Design of Inclined ZnO Film SAW Devices | MPEE | Poster

Surface acoustic wave (SAW) that propagate on the surface of piezoelectric materials have large number of potential applications, particularly in biosensing and microfluidics (including micro-droplet transportation, mixing, and ejection), which are two major components for lab-on-chip systems. ZnO is one of the common piezoelectric materials that has been used in high performance SAW based microsensors, microfluidics for lab-on-chip, drug screening and environmental devices with low cost, fast response, reduced reagent requirement and precision. However, many biosensors need to detect chemical reactions in a liquid environment. For bio-sensing in liquids, it is necessary to generate a shear horizontal mode wave, where the wave displacement is within the plane of the crystal surface. Based on this, a SAWs device was design on the ZnO film with an c-axis (0001) inclined angle of 45°, for which, the fingers of IDT were parallel to the surface texture of ZnO film. The S11 results shows there are 2 new peaks at 51.0 MHz and 58.4MHz with strong signal strength corresponding to the shear wave modes.

Nashad, Farhat

Broadband Compact Ku-band Meshed patch Antenna Element Integrated with Solar cells for Satellite Application at Remote Areas | MPEE | Presentation

This paper presents, a new design of dual-band compact microstrip suspended meshed patch antenna integrated with solar cells for Ku-band satellite applications. This antenna used for two-way satellite internet and TV receiving applications at rural and remote locations, the operating frequency ranges from 11.7 GHz to 12.2 GHz for downlink band and 14.0 GHz to 14.5 GHz uplink band allocated by the International Telecommunication Union (ITU) to the Regions 1 and 2. The proposed antenna size is 6.0 mm x 6.0 mm and printed on Plexiglas transparent substrate with thickness of 1.5mm. This antenna is simulated in CST Microwave Studio and achieved the broadband width of 500 MHz in both portions and the nominal element gain is 5.9 dBi downlink and 7.5 dBi uplink. The *antenna* is fabricated and measured; the experimental results and simulations by CST are compared and shown good agreement in the return loss (S_{11}) and input impedance matching. Trade-off between RF performances and transparency is also obtained.

Nwankwo, Stephen

Development of SnS-based Thin Films and Solar Cell Devices | MPEE | Poster

Tin Sulphide (SnS) is one of the most promising yet under-explored light absorbing material for cost effective and high efficiency photovoltaic cells. SnS thin films unlike CdTe are non-toxic and in contrast to CIGS does not contain rare and expensive elements [1,2], but the low efficiency of SnS based thin film solar cells which to date is limited to 4.4% is still a challenge [3]. Defects and impurities in SnS layers as well as small grain sizes related to the chemical nature of the substrate and growth conditions have the pontential of contirbuting to weak performance of the SnS-based solar devices. Here 5N purity SnS pellets were thermally evaporated onto soda lime glass (SLG), quartz, SLG/Mo and quartz/Mo substrates at an optimised growth temperature of 350 °C as well as 325 °C and 400 °C with a fixed deposition rate of ~30 $Å s^{-1}$. The effect of substrate type and temperature on the structural, morphological and optical properties of the layers has been studied. Randomly oriented multifaceted grains observed on SLG and SLG/Mo substrates change to a platelet-like and nearly columnar structure with a net increase in grain size when deposited on quartz/Mo substrate. Crystallinity of the films were improved by elevating the substrate temperature to 350 °C.

Raza, Mohsin

Deterministic Scheduling in Industrial Wireless Sensor Networks | MPEE | Presentation

Industries have significantly changed over the years. The present-day industries incorporate many applications, and complex processes, hence, a large number of sensors with dissimilar process deadlines and sensor update frequencies will be in place. For such diverse networks, Industrial Wireless Sensor Networks (IWSNs) offer a suitable solution. However, to improve network lifetime and communication reliability of the IWSNs, the diverse deadlines and update frequencies of various sensors must be carefully handled. The presentation will discuss a scheduling algorithm, which takes in account the varying deadlines of the sensors connected to the cluster-head, and formulates a static schedule for communication of the information from different blocks of industry to central control unit. The presentation will discuss the IEEE802.15.4e superframe structure and suggest superframe structure modifications to improve reliability. Since the static schedule generated by the scheduling algorithm offers reduced energy consumption, improved reliability, efficient network load management and improved information to control bits ratio, therefore a comparison with the existing technology will also be presented.

Ruiz-Gutierrez, Elfego

Snap-evaporation of droplets on smooth surfaces | MPEE | Poster

Snap-evaporation of droplets on smooth surfaces Stick-slip evaporation is a widely used model to explain the evaporation of sessile droplets. During stick-slip evaporation, the shape of the droplet it has is subject to pinning and depinning of its edge from the solid surface. Surface pinning is attributed to either chemical or topographical defects on the solid. [1] Therefore, predicting and controlling the shape and position of a droplet during the process of evaporation is a major challenge. [2, 3, 4] Recently, it has been shown that by replacing a dry solid surface by a flat liquid-infused surfaces (LIS), the edge of an evaporating droplet can be exempted from pinning. [5] In this work, we show how on a non-flat slippery surface, an evaporating droplet, undergoes a predictable motion, where the droplet's shape undergoes a series of sudden reconfigurations which we call "snaps". We focus on droplets, up to a few millimetres in size, for which the evaporation duration is enough to allow its mechanical equilibrium. Nonetheless, using a local stability analysis and lattice-Boltzmann simulations, we show that the stability or even the existence of these equilibrium states can be lost as the droplet volume varies, thus causing a snap to a new quasi-static shape. Unlike stick-slip evaporation, during snap evaporation the position of droplets can be controlled by topography. This can be exploited in the design of pinning-free surfaces for purposes of heat and mass transfer by evaporation.

Xu, Xinya

Flexible Cu2ZnSn(S,Se)4 solar cells made from nanoparticle inks | MPEE | Poster

$Cu_2ZnSn(S,Se)_4$ (CZTSSe) fabricated from Cu_2ZnSnS_4 (CZTS) nanoparticle inks have the advantages of being relatively low-cost and suitable for large area manufacture. In addition, fabrication on flexible substrates has the potential to create lightweight solar cells that offer a wide range of application. However, research on CZTS nanoparticle inks on flexible substrates is still comparatively rare.

In this work, flexible CZTSSe photovoltaic absorbers are prepared from CZTS nanoparticle inks fabricated by injection of metallic precursors into a hot surfactant. Following fabrication of a nanoparticle ink, CZTS nanoparticle thin films are then deposited onto a 0.1 mm thick flexible Mo foil using the spin-coating method. Subsequently, the CZTS thin films are annealed in a selenium rich atmosphere to convert nanoparticles into CZTSSe photovoltaic absorbers, which are then integrated into a conventional thin film solar cell structure. For comparison, solar cells are also fabricated using rigid soda lime glass (SLG) as the substrates. For the rigid solar cells, a 500 nm thick layer of Mo is sputtered on SLG as the back contact while all other conditions are kept identical to the flexible CZTSSe solar cells.

A range of characterisation techniques are used to study the behaviour of both CZTSSe photovoltaic absorbers and solar cells. The device on SLG chieved a efficiency of 4.0 %, but the efficiency of the device on Mo foil drops down to 1.5 %, while it recovered back to 3.8 % when pre-sputtered a layer of thin Mo film on substrates.

Zong, Yan

Discrete Pulse-Coupled Oscillators (PCO) for Precise Time Synchronization in Wireless Sensor Networks | MPEE | Poster

Timing is crucial in many time-sensitive wireless sensor networks (WSNs) applications, such as intruder detection, localization, structure health monitoring, cooperative environment monitoring and so on. The discrete Pulse-Coupled Oscillators (PCO) is used to describe the clock in WSNs. And the proposed proportional correction method has a good performance in attenuating the measurement noise to obtain a more accurate measurement offset. As a discrete event simulator, OMNeT++ is selected to develop a realistic simulator to evaluate the proposed PCO time synchronization algorithm, because software simulator uses an order sequence of well-defined event in time to represent the behavior of a complex network. The proposed algorithm is evaluated on the open-source software simulator implementing a more stable Clock A and a less stable Clock B, and the accuracy of proposed correction algorithm is sub-microsecond (i.e., 10^{-4}).